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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

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First Named Inventor	WARBY, Richard
Art Unit	
Examiner Name	
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ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
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  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
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- [ ] Information Disclosure Statement
- [x] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
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- [ ] After Allowance communication to Technology Center (TC)
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- [x] Other Enclosure(s) (please Identify below):

Three (3) Certified Priority Applications; itemized postcard

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Chad D. TILLMAN MORRIS, MANNING & MARTIN, LLP
Signature	Chad D. Tillman
Date	SEPT. 29, 2003

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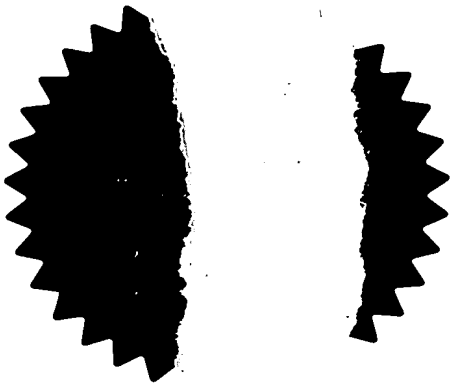

Signed R. Mahoney

Dated 3 September 2003

Patents Form 1/77

The Patent Office

1/77

Patents Act 1977
(Rule 16)

27APR98 E356014-5 D02882
P01/7700 25.00 - 9808804.0

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(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1.	Your reference	**TAB/50506/000**
2.	Patent application number *(The Patent Office will fill in this part)*	**9808804.0**
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	**BESPAK PLC** **BERGEN WAY** **NORTH LYNN INDUSTRIAL ESTATE** **KING'S LYNN** **NORFOLK PE30 2JJ** **UNITED KINGDOM**
	Patents ADP number *(if you know it)*	00338079001
	If the applicant is a corporate body, give the country/state of its incorporation	**UNITED KINGDOM**
4.	Title of the invention	**IMPROVEMENTS IN DRUG DELIVERY DEVICES**
5.	Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	**BOULT WADE TENNANT** **27 FURNIVAL STREET** **LONDON** **EC4A 1PQ**
	Patents ADP number *(if you know it)*	**42001**

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number (if you know it)	Date of filing *(day/month/year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application		Date of filing *(day / month / year)*
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	**Y**		

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	4
Claim(s)	1
Abstract	
Drawing(s)	1 +1

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Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	1
Any other documents *(Please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature

Date 24 April 1998

12. Name and daytime telephone number of person to contact in the United Kingdom

MRS. T.A. BUCKS
0171 404 5921

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IMPROVEMENTS IN DRUG DELIVERY DEVICES

This invention relates to improvements in drug delivery devices and particularly those for dispensing a metered dose of a medicament.

In metered dose inhalers, an aerosol stream from a pressurised dispensing container is fired towards a patient or user of the inhaler into an air flow. The air flow is created by a user inhaling through a mouthpiece of the inhaler and the medicament is released into this air flow at a point between the air inlet holes and the mouthpiece.

Other drug delivery devices include apparatus in which capsules containing a powdered medicament are mechanically opened at a dispensing station where inhaled air subsequently entrains the powder, which is then dispensed through a mouthpiece.

A problem with all such drug delivery devices is that deposition of the medicament on the internal surfaces and other components of the devices occurs after a number of operation cycles and/or storage. This can lead to reduced efficiency of operation of the device and of the resulting treatment in that deposition of the product reduces the amount of active drug available to be dispensed. Although deposition predominantly applies to dispensers of powder suspensions, it can also occur in devices for dispensing solutions.

It is an object of the present invention to provide drug delivery devices in which the deposition of the product and active drug component is minimised.

According to the invention there is provided apparatus for dispensing a medicament comprising a housing adapted to receive a container for storing the medicament, a mouthpiece and duct means connecting an

outlet of the container with the mouthpiece, wherein at least a portion of one or more of the internal surfaces of the duct and/or mouthpiece which come into contact with medicament during dispensing is treated to have a layer of plasma polymer bonded to at least a portion thereof.

A particular embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawing which is a cross-sectional view through an inhaler, which is one type of drug delivery device of the present invention.

In Fig. 1 an inhaler 10 for a product such as a medicament comprises a housing 11 for receiving a pressurised dispensing container 12 of a medicament and a mouthpiece 14 for insertion into the mouth of a user of the inhaler 10.

The container housing 11 is generally cylindrical and open at its upper end. A lower wall 15 of the housing 11 includes an annular socket 16 for receiving the tubular valve stem 17 of the container 12. The socket 16 communicates via a duct 18 ending in an orifice 19 with the mouthpiece 14. The lower wall 15 also has holes 20 for allowing air to flow through the container housing 11 into the mouthpiece 14.

The mouthpiece 14 may be generally circular or shaped to fit the mouth and is connected to or forms a part of the housing 11.

In use, a patient or user holds the inhaler 10, usually in one hand, and applies his mouth to the mouthpiece 14. The user then inhales through the mouthpiece 14 and this creates an airflow through the cylindrical housing 11, from its open end around the dispensing container 12, through the holes 20 and into the mouthpiece 14. After the user has started inhaling through the mouthpiece 14, the container 12

is depressed downwardly onto its stem 17 to release a dose of medicament from the container 12. The dose of medicament is projected by the pressure in the container 12 via the duct 18 and through the orifice 19. It then mixes with the airflow through the mouthpiece 14 and is hence inhaled by the user.

In traditional inhalers, all of the components are plastic mouldings, which gives rise to the deposition problems described above. The particular problem areas in devices such as inhalers are the internal surfaces 21 of the mouthpiece 14, the internal surfaces 22 of the duct 18 and the walls 23 defining the orifice 19. In some inhalers 10, the diameter of at least a part of the duct 18 can be as little as 0.5mm and so any deposition on its internal surfaces 22 could lead to not only the problem of a reduction in active drug components being available, but also dispensing difficulties.

The component parts of conventional drug dispensing devices are generally formed as single mouldings from material such as acetal, polyester or nylon which are prone to the deposition problems described above. Although in some cases it might be possible to include a separate liner of a material such as a fluoropolymer, ceramic or glass to line a portion of the area in which deposition problems occurs, this requires the re-design or modification of mouldings and mould tools so that the components can accommodate such lines. In the present invention the component parts of the drug dispensing devices are made by conventional tooling and moulds from the traditional materials listed above. They are then subjected to a cold plasma polymerisation treatment which creates a very thin layer of the plasma polymer, such as plasma polymerised tetrafluroethylene, on the

surface of the component parts which significantly reduces the deposition of active drugs on the relevant surfaces.

The process is known as "cold plasma" treatment as the temperature within the body of the plasma is ambient. Thus thermoplastic materials such as PBT, nylon and acetile can be treated without fear of thermal damage. The treatment is a vacuum procedure in which the components are placed inside a chamber which is evacutated to less than 0.005 Torr. A monomer is introduced to the chamber at a controlled rate and a 13.56 MHz r.f. signal is applied to an external antenna. The plasma is ignited within the chamber and maintained for a given time at the preselected power setting. At the end of the chamber the plasma is extinguished, the chamber flushed and the products retrieved. As a result of a thin layer (for example 0.005 to 0.5 microns) of, say, plasma polymerised tfe is intimately bonded to the surface of the component.

Either an entire component, or just the surfaces which would come into contact with the medicament during actuation, could be treated to provide an improved drug delivery device according to the present invention. In the case of inhalers as shown in Fig. 1, surfaces 21, 22 and 23 may be treated. In a typical dry powder inhaler, the inner surface of the mouthpiece and any channel leading to the mouthpiece from the point of powder storage, i.e. from a capsule, bulk storage chamber or a pre-metered chamber of a device. The method can also be used to treat components of many other delivery devices including nasal pumps, non-pressurised actuators, foil storage types, breath actuated inhaler devices and breath co-ordinating devices and so on.

CLAIMS:

1. Apparatus for dispensing a medicament comprising a housing adapted to receive a container for storing the medicament, a mouthpiece and duct means connecting an outlet of the container with the mouthpiece, wherein at least a portion of one or more of the internal surfaces of the duct and/or mouthpiece which come into contact with medicament during dispensing is treated to have a layer of plasma polymer bonded to at least a portion thereof.

2. Apparatus as claimed in claim 1 in which the plasma polymer is plasma polymerised tetrafluroethylene.

3. Apparatus as claimed in claim 1 or claim 2 in which the treated portion is made from a plastic polymer or synthetic rubber.

4. Apparatus as claimed in any one of the preceding claims in which at least a portion of the surfaces of the duct and the mouthpiece have a layer of plasma polymer bonded thereto.

5. Apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

FIG. 1.